County Conservation News

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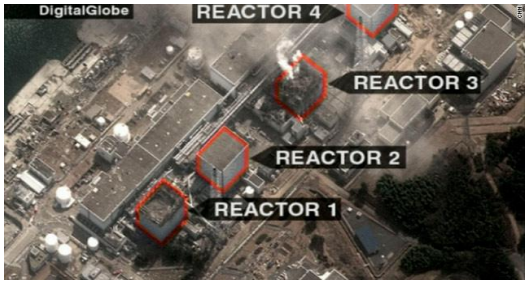
Contact Us

GreenTeam@co.lewis-clark.mt.us

Nuclear Disaster Strikes Japan

With the recent nuclear disaster at the Fukushima Daiichi plant in Japan, it seems as timely as ever to discuss the nuclear industry in full. We will recap the recent nuclear nightmare in Japan, the pros and cons of nuclear power, and a few statistics about nuclear power use.



Timeline of events at the Fukushima Daiichi nuclear power plant:

- Day 1: March 11, 2011[1]
  - At 2:46 p.m., Japan is struck by a 9.0 magnitude earthquake, the largest in its recorded history, and fifth largest worldwide. Eleven nuclear reactors in the surrounding area shut down automatically.
  - A powerful tsunami triggered by the earthquake sweeps away cars and homes. Flood waters at the Fukushima Daiichi nuclear power plant swamp generators, causing them to fail. The reactors begin to heat up.
- Day 2: March 12, 2011
  - At 6:22 p.m., a hydrogen explosion occurs at reactor No. 3, and blows the roof off the containment structure around reactor No. 1.
  - Workers begin injecting seawater and boric acid into the reactors in what some experts say is a last-ditch attempt to prevent a meltdown after the backup cooling systems for reactors No. 1 and 3 fail completely.

- Day 3: March 13, 2011
  - There is believed to be a partial meltdown in reactor No. 3, which is vented again.
  - The cooling system in reactor No. 2 fails and more radioactive steam is released. A company spokesman states that the radiation released thus far does not pose a health risk to humans.
  - Meanwhile, in southwestern Japan, Shinmoedake volcano erupts for the second time in 2011, sending ash and rock more than two miles into the air. Analysts say it was the biggest volcanic activity there in 52 years.

- Day 4: March 14, 2011
  - At 11:00 a.m., a hydrogen explosion at the No. 3 reactor damages the cooling system at the No. 2 reactor and injures 11 people. A wall at the plant collapses as a result of the blast, but officials say the containment vessel surrounding the reactor remains intact.
- Day 5: March 15, 2011
  - At 6:00 a.m., an explosion hits reactor No. 2. Readings indicate some damage to the reactor's suppression pool, a donut-shaped reservoir at the base of the reactor's containment vessel.

  - At 8:54 a.m., a fire is ignited in the No. 4 reactor building, and is reported to be extinguished at 11:00 a.m.
- Day 6: March 16, 2011
  - At 7:00 a.m., a fire breaks out at the building housing the No. 4 reactor. It is believed to be the same spot where a fire broke out the previous day.
- Day 7: March 17, 2011
  - Helicopters operated by Japan's Self-Defense Forces begin dumping tons of seawater from the Pacific Ocean onto the No. 3 and 4 reactors to reduce overheating. Hours later, the operation appears to be unsuccessful.
  - The Japanese Defense Ministry uses five water cannons to blast water into the No. 3 building.
- Day 8: March 18, 2011
  - Japan's nuclear agency has upgraded the incident level to 5, previously at 4. The Three Mile Island incident was rated a 5, and Chernobyl was rated a 7 (1-7 scale).

- Day 9: March 19, 2011[2]
  - Efforts were accelerated to restore power to nuclear reactors' cooling systems. Officials said workers hope to fully restore power by day's end Saturday to plant's No. 1, 2, 5 and 6 reactors, and to get power up and running Sunday for the No. 3 and 4 reactors.
  - Japan's National Police Agency says that 7,348 people are now confirmed dead, 10,947 are missing, and 2,603 people have been injured.
- Day 10: March 20, 2011
  - Crews struggling to bring the plant under control had some success as cooling systems at two of the facility's reactors were working, Kyodo News reported.
  - The pressure in the containment vessel of reactor No. 3 is increasing, according to Japan's nuclear safety agency. The agency said officials are planning an operation to reduce pressure in the vessel -- the steel and concrete shell that insulates radioactive material inside.
  - Japan's National Police Agency says that 8,199 people are confirmed dead, 12,722 have been reported missing, and 2,612 people have been injured due to the March 11 quake and tsunami.

- Day 11: March 21, 2011
  - Electricity has been restored to three reactors.
  - Gray smoke is seen rising from reactor No. 3, and later white smoke is spotted rising from reactor No. 2.
- Day 12: March 22, 2011
  - Engineers have reconnected all six reactors to the electrical grid.
- Day 13: March 23, 2011
  - Gray smoke is spotted coming from reactor No. 3.

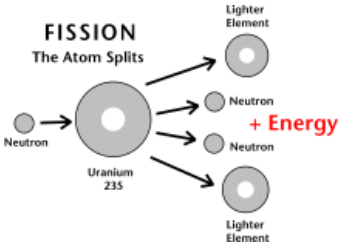
To date, the earthquake and tsunami are officially responsible for 9,811 deaths and 17,541 missing persons. No deaths or life threatening injuries are attributed to the nuclear crisis that followed. Japan's government estimates the total cost of the destruction to infrastructure, housing and business facilities to be approximately $309 billion.

Nuclear Power: Pros and Cons

Nuclear power derives its energy from the nucleus (core) of an atom. Atoms are tiny particles that make up every object in the universe. Energy from the atom can be released in two ways: fission or fusion.

Fusion releases energy when two atoms are combined or fused together to form a larger atom. This is how the sun produces energy. Fusion is capable of producing tremendous amounts of energy (in accordance with $E=mc^2$).

Fission releases energy when an atom is split apart into smaller atoms. The energy released in a fission reaction is heat energy, which is captured and used to heat water, to produce steam, to turn a turbine, to turn a generator, to generate electricity. Nuclear fission is the current technology used to produce electricity at a nuclear power plant. The technology to perform nuclear fusion is not currently available.



The fuel most commonly used by nuclear plants is uranium. Uranium is a common metal found in rocks all over the world. Nuclear plants use a certain kind of uranium, referred to as U-235. This kind of uranium is used as fuel because its atoms are easily split apart. Though uranium is quite common, about 100 times more common than silver, U-235 is relatively rare.[3]

Nuclear power is highly debated because it has significant pros and cons. First, the pros:

- **Clean**: Amongst growing concern over climate change, nuclear power provides baseload electricity while emitting extremely low amounts of greenhouse gases. It is the only clean energy source readily available that has the capacity to be used as baseload power. Wind and solar cannot act as baseload power sources because the wind is not always blowing and the sun's energy is not always available.
- **Cost**: The capital cost of building a nuclear power plant is extremely high, but the fuel and operating costs are extremely low. Overall, the costs are competitive with traditional coal, and much cheaper than clean coal would be.
- **Resource wars**: Uranium is evenly distributed around the world, which alleviates some concern over resource wars.

And the cons:

- **Security**: Although there is concern that radioactive waste, or recycled waste, could be used to build a nuclear weapon, it is probably not possible to create weapons grade plutonium from such waste. There is also concern, however, that radioactive waste could be used to create a "dirty bomb" (a bomb that combines radioactive material with conventional explosives), spreading radiation in a local area.
- **Waste disposal**: On average, a nuclear power plant generates about 20 metric tons of high-level radioactive waste per year. The entire nuclear industry generates about 2,300 metric tons of used fuel per year. Over the past 40 years, the industry has produced 62,500 metric tons of waste.[4] This waste takes tens of thousands of years to lose its radioactivity, and must be carefully guarded because the waste can be used to make weapons. The acronym N.I.M.B.Y is often used to describe the public's feelings about disposal and storage of nuclear waste – not in my backyard.
- **Nuclear Accidents**: Accidents at Chernobyl (directly killed 30 people, thousands died of radiation poisoning in the years to follow) and Three Mile Island (killed 0 people) struck fear into Americans and put a halt on the growth of nuclear power in the United States for the past 30 years. The nuclear industry had been gaining a lot of support recently; however the Fukushima Daiichi accident threatens to slow down that momentum.

Nuclear Around the World

Whether you think nuclear power is the solution to the world's energy problems, or the eventual cause of the end of the world (i.e. nuclear holocaust), nuclear power makes up a significant portion of the world's energy needs:

- The United States has 66 operating nuclear power plants (104 reactors), more than any other country in the world.
- Nuclear generates 20% of electricity in the United States and meets 8.35% of its energy needs.
- Illinois, Pennsylvania, South Carolina, New York and Texas (respectively) generate the most electricity from nuclear in the U.S.
- The only nuclear reactor currently under construction (in the U.S.) is the Watts Bar 2 in Tennessee, which was about 80% complete when its construction was stopped in 1988. Construction restarted in 2008 and is expected to be completed in 2012.
- In 2009, nuclear power provided 14% of the world's electricity.
- Lithuania relied on nuclear to generate 76.2% of its electricity in 2009, and France used nuclear to generate 75.2% of its electricity.
- Japan relies on nuclear to produce 27% of its electricity demand.[5]

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[1] CNN News. http://articles.cnn.com/2011-03-15/world/japan.nuclear.disaster.timeline_1_power-plant-reactor-containment-structure?_s=PM:WORLD

[2] The Christian Science Monitor. http://www.csmonitor.com/World/Asia-Pacific/2011/0315/Japan-nuclear-crisis-week-2-A-timeline-of-key-events/%28page%29/3

[3] Energy Information Administration (EIA). http://www.eia.doe.gov/nuclear/

[4] Nuclear Energy Institute. http://www.nei.org/resourcesandstats/nuclear_statistics/nuclearwasteamountsandonsitestorage/

[5] EIA. http://www.eia.doe.gov/energyexplained/index.cfm?page=nuclear_use